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subject to chemical analysis. Whereas most samples had low to moderate concentrations of metals, DDT and PCBs, a high PCB concentration (>2.9 ppm) was found in one sample from Hampton Harbor (Figure 2.25), and a high concentration (>125 ppm) of vanadium was found in two samples from Rye Harbor. On the Maine side of Portsmouth Harbor, high concentrations of copper (>342 ppm), lead (>285 ppm), mercury (>3.0 ppm) and zinc (>436 ppm) were measured in numerous samples from the Portsmouth Naval Shipyard.

The estuarine chemistry of tin in its various inorganic and organic forms has been extensively studied (Weber et al., 1995). The studies have largely occurred in the Great Bay Estuary, providing information on the concentrations and dynamics of tin species in coastal New Hampshire. The estuarine chemistry of mercury has been the focus of more recent studies by the same group (Puk and Weber, 1994; Weber et al., 1998). Ongoing and pending studies are designed to determine atmospheric deposition, extensive spatial determinations of mercury concentrations in sediments, and elucidation of the biological cycling of mercury species in saltmarsh sediments in the Great Bay Estuary.

An assessment of fecal-borne microbial contaminants in sediments and water around the Portsmouth Naval Shipyard was made from September 1991 to June 1993 (Jones, 1994). The purpose was to use fecal-borne bacteria as evidence for the presence of sewage-borne waste materials, and to use such evidence to help establish the sources of the toxic contaminants found around the Shipyard. Measurements were made of *Clostridium perfringens* in water and in surface and subsurface sediments at 28 sites in the vicinity of the shipyard and in York Harbor from September 1991 through June 1993. *C. perfringens* concentrations were relatively low in water samples near the shipyard and site 23 in York Harbor had the consistently lowest levels of all sites. The highest levels of contamination in surface sediments and sediment cores were generally near

Seavey Island, site 2 off New Castle and the Rt. 95 bridge, while lower levels of *C. perfringens* were apparent at sites in channels away from the Piscataqua River and in York Harbor. Sediment core profiles showed highly contaminated layers at some sites. Comparison of *C. perfringens* to lead and mercury concentrations showed similar trends in spatial distributions. The relationship between trace metal contaminants and the fecal-borne bacterial indicator suggests that some metals in sediments around the shipyard are probably associated with sewage effluent.

Besides microbial indicators of fecal contamination, there are numerous chemicals that are useful indicators of specific sources of nonpoint source pollution. Studies on the Portsmouth Naval Shipyard focused on a range of chemical markers and indicator compounds for sewage, atmospheric deposition, petroleum and runoff. Results suggested that sewage is a major source of heavy metals and toxic organic contaminants to the lower estuary, and other sources such as atmospheric deposition, urban runoff and petroleum spills also contribute contaminants (Bowen and Pruett, 1994).

Overall, the estuarine sediments of New Hampshire are contaminated with some trace metals and toxic organic compounds at relatively high levels. Most significant sources of contaminants are historical and similar or worse contaminated conditions have existed for over 20 years in some cases. The transport of contaminants with resuspended sediments throughout the Great Bay Estuary has been documented. Of course, transport of floating oil during significant spills is a well-documented example of contaminant transport. The potential for contamination even from remote sources, either naturally occurring or as a result of dredging and oil spills, is an ever-present threat. Prevention of further loading of contaminants where management is possible is thus an important concern. A coordinated monitoring program that includes periodic analysis of sediments is needed to determine temporal trends for sediment contaminants.

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